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THE MILROY LECTURES ON KALA-AZAR,
ITS DIFFERENTIATION AND ITS EPIDEMIOLOGY

L. ROGERS

Lecture I - The origin and course of
the epidemic

Lancet, 1907, i.



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ABSTRACT OF

The Milroy Lectures

ON

KALA-AZAR, ITS DIFFERENTIATION AND ITS EPIDEMIOLOGY.

*Delivered before the Royal College of Physicians of London*BY LEONARD ROGERS, M.D. LOND.,
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CALCUTTA.

LECTURE I.

Delivered on Feb. 21st.

THE ORIGIN AND COURSE OF THE EPIDEMIC.

MR. PRESIDENT AND GENTLEMEN,—I regard my good fortune in being appointed to deliver the Milroy lectures this year as being due to a desire on the part of this College to recognise the work now being done in the investigation of tropical diseases. My responsibilities are, therefore, unusually heavy, while my difficulties are enhanced by the disease I have to deal with being unfamiliar in this country, although this is to some extent counterbalanced by the great interest and importance of the subject. I will, therefore, commence with an extended definition of the disease embracing the main points I shall deal with much in the order in which they will be taken up.

Kala-azar, then, is the epidemic manifestation of a fever, endemic in extensive areas of India, which has spread slowly for 30 years up the Assam valley as a wave of greatly increased mortality, dying out largely as it passes on, after causing a decrease in the population and the falling out of cultivation of much land in the affected tracts, travelling along lines of communication, and checked by high elevations and extensive areas of unpopulated jungle, and now, happily, largely on the decrease. It is precisely similar in nature to a previous epidemic in Bengal, known as the Burdwan fever. Cases of the epidemic disease are identical, when individually considered, with the sporadic fever known for centuries in India as "malarial cachexia," and it is characterised by very persistent fever of an alternating remittent and intermittent type, commonly mistaken for typhoid fever in the earliest remittent stage, but rapidly leading to a cachectic condition with great enlargement of the spleen, and later of the liver, and extreme wasting, the fever lasting from a few months to several years and commonly terminated by some complicating affection, the mortality being from 98 per cent. at the height of the epidemic down to 75 per cent. at its end. The disease in its progressive stages is constantly associated with, and pretty certainly caused by, a minute protozoal organism, which has been shown by a remarkable cultivation outside the body to be one stage of a flagellated parasite, while a study of the conditions most favourable to this development of its extra-corporeal stage strongly indicates some biting insect as the carrier of the infection, a view which is also in accordance with a number of facts regarding the spread of the disease and the success which has attended efforts to check its further extension and to stamp it out of infected places which were made before the discovery of the parasite and also recently confirmed by certain feeding experiments.

To-day I propose to deal solely with the subject in its epidemiological aspects, taking it up as a disease individually considered in the second, and describing the life-history of the parasite and its bearing on the mode of infection in my third lecture.

THE ORIGIN OF THE EPIDEMIC.

Kala-azar first attracted public attention in 1882, when Dr. Clarke, the Sanitary Commissioner with the Government of Assam, in his annual report gave an account of the disease, based on the notes of 120 cases compiled by Mr. J. McNaught, the civil medical officer of the Garo hills: He described it as a very severe form of malarial cachexia which was depopulating certain areas at the foot of the Garo hills, believed by the Garos to be infectious, and obtaining its name from a peculiar dusky hue which the sufferers presented, the term meaning "black fever." The

disease had been known there in its sporadic form since 1869, when the country was first occupied by the British, but the exact date of the origin of the spreading epidemic was obscure when I went to Assam in 1896. I therefore visited the Garo hills to examine all the medical and administrative records and ascertained that the Government land rent was paid in full up to 1875, when it was recorded that a deficiency occurred in some of the villages at the south-west corner of the district owing to several families having died from kala-azar, and from this time onwards it was regularly referred to year by year as causing the deaths of a large proportion of the people of various villages, thus occasioning a loss of revenue and the depopulation of certain areas at the foot of the hills just to the east of the Brahmaputra river. By 1881 numerous villages had quite disappeared, while the epidemic had travelled towards the centre of the hills, and then passed by a bridge path out again to their foot on the north side to reach Damra in the south of the Goalpara district. It is clear, then, that although the disease had doubtless long been present in a sporadic form at the western foot of the Garo hills, just as it is known to have been in the Rungpore district on the west of the Brahmaputra river, yet it was not until about 1875 that it assumed the epidemic spreading form, depopulating tracts of country and immediately causing a marked loss of revenue—characteristics which it maintained during its subsequent spread up the Assam valley during the succeeding three decades.

Moreover, about 1875 the disease also appeared in an epidemic form in a village to the south of Dubri, some 50 miles north of the above-mentioned place of origin, a distance which it subsequently took about five years to traverse, and it is worthy of note that these two places were each situated close to where a ferry crossed the river from Rungpore, while in two of the earlier reports on the disease it is stated that the Garos themselves asserted that the epidemic came from Rungpore. Now between 1871 and 1879 there was a terrible outbreak of fever in the Rungpore and in the neighbouring western Dinajpur districts, which was noted in 1875 as especially affecting the low banks and islands of the Brahmaputra river (so doubtless also involving the foot of the Garo hills) and causing a decrease in the population of Rungpore between the censuses of 1872 and 1881, against a marked increase in Bengal generally. This fever outbreak was coincident with an unprecedented series of five out of six years of deficient rainfall, while to this day short rains are always accompanied by excessive fever mortality in that part of Bengal, so that there can be little doubt that the epidemic was caused by this extraordinary succession of unhealthy seasons, which I suggested in my original report intensified the ordinary malarial fever of the district until it assumed a spreading epidemic form. The explanation of the phenomenon in accordance with the now known pathology of the disease I must leave until the life-history of the parasite has been discussed.

THE SPREAD OF THE EPIDEMIC.

The details of the spread of the disease have been embodied in the accompanying map of Assam (Diagram I.), the large figures, such as 75–83 in the Garo hills, showing the years during which there was a marked increase in the fever death-rate in each of the affected districts, while the smaller separate ones illustrate the exact year in which the disease was noted to have commenced in that particular place. It is noteworthy that the southern higher portion of the Garo hills largely escaped the epidemic, while, although the disease first appeared at the extreme south-west of the hills, yet it never spread along the southern border into the thickly populated tracts of Mymensingh and Sylhet, the explanation of which will appear presently.

Coming next to the Goalpara district, we find that the large sparsely populated portion to the north of the Brahmaputra river was very little affected. On the other hand, the narrow southern terai tract between the river and the Garo and Khasai hills, traversed by the grand trunk road from opposite Dubri to the headquarters of the Goalpara and on through the southern portion of the Kamrup district to the large town of Gauhati, suffered very severely. Goalpara was at its worst between 1882 and 1887, relief works being started there in 1884, the disease being still reported to be only malarial in nature and certainly not contagious, while as early as this it was stated that "the epidemic is extending, counterbalanced by the fact that it is now absent where it has been severe." Moreover, in 1886, it was

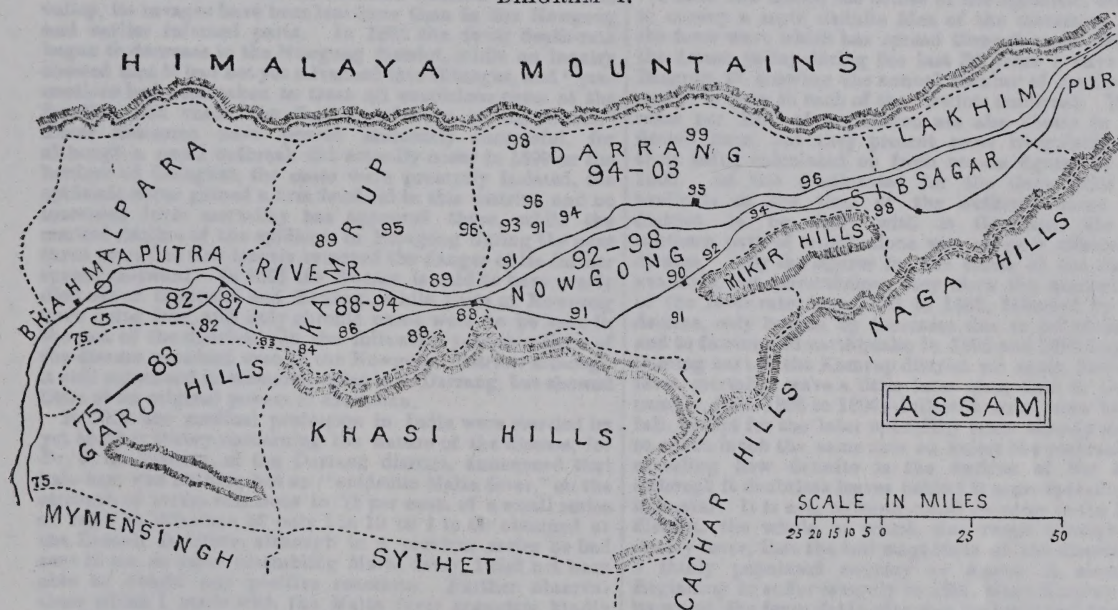
recorded of a tract in the Garo hills, some 70 miles in extent, which had suffered most severely from the disease, "It would be hard to find one single case of the real disease, kala-azar." It is clear from this that the decline of the epidemic is just as marked a feature as its rapid rise in any district.

In the meantime the southern portion of Kamrup was invaded and some of the villages on the north bank of the great river gradually became infected, about ten miles of new country being invaded each year, where communications were good, while the disease leapt on into the town of Gauhati in 1888, in accordance with the more active intercourse between that place and the infected villages than with some of the intervening and later infected hamlets. On the north bank the spread was less rapid in accordance with the slighter degree of active intercourse between the more scattered villages of that tract, there being no much frequented main road on the north bank of the river. Once Gauhati became severely infected, the disease spread across the river by a main road into the western Mangaldi subdivision of the Darrang district, and at the same time it continued its steady eastward course along the trunk road into Nowgong district, leaping on once more into the town of that name in 1890.

ankylostomiasis." This identity of the clinical pictures can only be explained by Dr. Giles having rejected the typical cases of kala-azar as being merely "the common malarial cachexia of Assam" and only regarded cases of ankylostomiasis as the true cause of the increased mortality, that is, kala-azar as he saw it. Unfortunately, he did not examine the healthy people for the intestinal parasite, so when soon after his report appeared Dr. Dobson showed that 80 per cent. of healthy coolies imported from various parts of India, who had passed two medical examinations, harboured this worm, Dr. Giles's theory received a fatal blow, and in 1896 a fresh investigation was ordered, which I was fortunate enough to be selected to carry out.

In the course of a year's study I found that the ankylostomes were no more common in any stage of kala-azar than in the uninfected people, while the anæmia produced by this worm was of a chlorotic type and differed so widely from the pernicious type met with in kala-azar as to alone serve for the complete separation of the two diseases, thus finally disproving Dr. Giles's theory. Moreover, I found malarial parasites frequently present in all stages of the disease, a complication now readily explained by the then unknown fact that in very malarious places a large proportion of the healthy persons show malarial parasites in their blood, for on

DIAGRAM I.



Map showing the kala-azar district in Assam. It begins at the bottom left-hand corner of the map and its north-easterly extension is marked by the numerals which denote the year of its first appearance in each locality.

In the meantime attention had been called in Ceylon to the amount of anæmia produced in coolies by the ankylostomum duodenale, and Dr. Ruddock had also found ankylostomiasis to be common in Assam, where it was readily cured by thymol. Dr. G. M. Giles was therefore sent to Assam late in 1889 to investigate both kala-azar and anæmia of coolies, and rapidly came to the conclusion that they were one and the same disease and caused by the ankylostomes, and he reported to this effect in 1890. He found, indeed, that many of the cases showed symptoms of malarial poisoning, but as enlarged spleen was very common in healthy people in Assam he considered that "it is obviously absurd to attach any pathognomonic importance to the symptom in connexion with the etiology of kala-azar," and after studying anæmia of coolies in the eastern part of the valley, where there has never been any kala-azar to the present day, he wrote, "Nothing here struck me so strongly as the absolute identity of the clinical pictures presented by these cases of acknowledged ankylostomiasis with those I had been seeing so much of under the name of kala-azar," and he therefore concluded that, although malaria causes much death-rate in Assam, there had been no changes in the country which could intensify it, and "it is entirely inadequate to serve as the efficient cause of the terrible death-rate of kala-azar stricken villages, and the true cause of this will be found to be neither more nor less than

revisiting the Nowgong district in 1904 I found the endemic index, or percentage of healthy children with malarial parasites in their blood, no less than 80 on some of the very tea gardens where I had studied kala-azar in 1896. Further, I was unable to find any differences between kala-azar and malarial fever in any stage, malarial pigment being almost constantly found in the organs of kala-azar subjects post mortem, while the typical cachectic later stages of kala-azar was identical with what has been known as "malarial cachexia" for centuries in Lower Bengal (but which we now know to be not all malarial but for the most part the sporadic form of kala-azar). I was therefore compelled to conclude: "The disease, then, is a very intense form of malarial fever," adding, "It is open, however, for anyone to say that there is something in the disease in addition to malaria, which I have not discovered, but which accounts for the spread of the infection." The mode of extension of the disease was also carefully studied and I was enabled to make some practical suggestions, the success of which has exceeded my most sanguine expectations, as will appear later. My view was largely accepted in Assam, although some still thought it was a new disease, but the difficulty in regarding malaria as infectious largely vanished when Ronald Ross's classical researches on the communication of malaria through the mosquitoes were published and still more when this great authority on

malaria, after a personal investigation of kala-azar in 1899, indorsed my opinion and after a careful discussion concluded, "I think, then, with Rogers, that kala-azar is malarial fever."

To return to the progress of the epidemic, we now arrive at a critical point, for the disease had reached the beginning of a narrow tract with but few inhabitants between the low Mikir hills and the Brahmaputra river, which stretched for some 40 miles before opening out again into the broader plain of the Golaghat sub-division of the Sibsagas district. I travelled through this country and found it to be still free from the dreaded kala-azar, but people from the infected tracts of Nowgong were already beginning to move towards Golaghat, and if nothing were done it could only be a matter of time before the open, more populated upper Assam valley became infected and the most favourable opportunity which had yet occurred of staying the epidemic would be lost for ever. I therefore strongly urged in my report that infected persons should be prevented from traversing this area and gave instructions for dealing with any villages which might become infected, and these measures were promptly put into operation by Sir Henry Cotton.

The subsequent history shows a steady decline in the prevalence of the disease, with the exception of slow extension in the already infected Darrang district north of the Brahmaputra river, although, owing to the population being much scattered in this, as in all the northern districts of the Assam valley, its ravages have been less here than in the Nowgong and earlier infected parts. In 1898 the fever death-rate began to decrease in the Nowgong district, while an inquiry showed that it had not yet advanced into Sibsagas, and "precautions had been taken to treat all suspicious cases at the frontier, and check the further advance at the outset." These measures have proved eminently successful, for although a small outbreak did actually occur in 1899 on the borders of Golaghat, the cases were promptly isolated, the epidemic never gained a firm foothold in this district, and no increased fever mortality has appeared there, while the marked decline of the epidemic in Nowgong during the next three years has now largely removed the danger of its further spread eastward. In 1901 the disease is said to have nearly died out of Goalpara and Kamrup, while parts of Nowgong were quite free, and only chronic cases were to be seen in the rest of the district. In the following year very little of the disease remained even in the Nowgong district, although it still continued in scattered villages in Darrang, but showed little of its original powers of extension.

In 1902 the medical profession in India were startled by yet another theory concerning the nature of the disease, for Dr. C. A. Bentley, of the Darrang district, announced that kala-azar was nothing but an "epidemic Malta fever," on the strength of serum reactions in 75 per cent. of a small series of cases in dilutions of only 1 in 10 to 1 in 40 obtained at the Kasauli Institute, although in a previous series he had sent to me, as cases resembling Malta fever, I had not been able to obtain any positive reactions. Further observations which I made with the Malta fever organism kindly supplied me by Colonel D. Semple, R.A.M.C., of Kasauli, showed that reactions in the low dilutions mentioned could occasionally be obtained with the blood of other diseases than Malta fever, and it has since been acknowledged officially that such low dilutions as had been employed in the kala-azar tests were of no diagnostic value, while Dr. Bentley has now recanted his theory.

In 1897 a great increase of the fever mortality occurred in Sylhet, to the south of the Khasai hills, following on the marked physical alterations in the district caused by the great earthquake, but two years later it had fallen again to nearly the normal, and has been very low again during the last few years, showing that there was no such prolonged wave of increased fever mortality as occurred in the kala-azar infected parts of the northern Assam valley just described. Nevertheless, the temporary increase of fever in Sylhet gave rise to inquiries, and it was reported in 1900 that kala-azar was widespread in the district, although a perusal of the reports shows that the disease was only of a scattered sporadic nature. Now in 1897 I had visited Sylhet for the purpose of seeing "malarial cachexia" in a district free from epidemic kala-azar and found a few cases, which, individually considered, were identical with the outbreak I was investigating. Indeed, it was the very close resemblance between the sporadic cases always known as malarial cachexia in Sylhet and Lower Bengal with those of the Assam epidemic which forced me to the conclusion that

the more serious spreading affection was but an intensified form of the sporadic "malarial cachexia," and this view is now seen to be correct, with the all-important modification introduced by the epoch-making discovery of the parasite of kala-azar—namely, that the great majority of the cases hitherto known as malarial cachexia in Lower Bengal, as well as in Madras, are not malarial at all but due to the recently discovered parasite of kala-azar. This occurrence of the sporadic form of the disease in Sylhet, as well as in Mymensing in Eastern Bengal, also serves to explain why the epidemic disease did not spread to those districts but passed round the north side of the Garo hills into the virgin soil of the Brahmaputra valley, previously free from the sporadic disease, and finding there a population fully susceptible to its deadly influences it there worked the most terrible havoc. It thus becomes clear that unceasing vigilance must continue to be exercised against the insidious extension of the disease into the still unaffected eastern portion of the Brahmaputra valley as long as it lingers in Darrang, while a careful watch must be kept to enable prompt measures to be adopted should any further unhealthy seasons originate a fresh outbreak in the same way that the epidemic was started at the foot of the Garo hills in 1875.

THE EFFECT OF THE EPIDEMIC ON THE FEVER DEATH-RATE AND ON THE POPULATION.

I have now traced the course of the epidemic, but in order to convey a more definite idea of the disastrous effects of the fever wave which has spread through some 300 miles of the Assam valley during the last 30 years I have prepared Diagram II, showing the annual number of deaths returned as due to fever in each of the districts traversed. The death-rates per 1000 of population are also shown in the dark dotted lines, but they present some irregularities due to their being calculated on fresh census figures in 1890 and 1900. As the death-rates for the Garo Hills are not available at the time of the outbreak there the first district to be dealt with is Goalpara, the smaller southern part of which alone was severely affected by the disease. Only the figures for the whole of the district are available, but, nevertheless, they show the marked increase of the fever-rate from 1883 to 1888, followed by a steady decline, only broken by increases due to influenza in 1891 and to famine and earthquake in 1896 and 1897 respectively. Coming next to the Kamrup district we again find a marked fever mortality wave a little later than that in Goalpara—namely, from 1888 to 1894—followed once more by a steady fall, except for the later unhealthy years already mentioned, to reach much the same rate as before the outbreak, clearly revealing how definite is the decline of the epidemic, although it doubtless leaves behind it some sporadic cases of kala-azar. It is not, however, until we come to the Nowgong district, the whole of which was swept through by this deadly fever, that the full magnitude of the disaster in such a thinly populated country as Assam is clearly seen. Beginning to suffer severely in 1892, when Kamrup was past its worst, the fever death-rate rose by leaps and bounds from an average of about 4000 a year previously to that year up to over 14,000 in 1897, and then declining still more rapidly to under 6000 in 1900 and to an average of about 4000 once more during the last five years. The apparent completeness of this fall, however, is partly due to the frightful depopulation of the district by the epidemic, for the death-rate per 1000 during the last few years averaged about 15.5 against 13 before the outbreak. The broken line in the Nowgong diagram indicates the birth-rate per 1000, and shows a marked decline during the height of the epidemic, as might have been expected, and this helps to explain the great decrease of the population to be mentioned presently.

Next we come to Darrang, which shows a less accentuated but more prolonged wave of increased fever mortality, due to the slower spread of the disease through this extensive and lightly populated district. Much of the increased number of fever deaths here shown, however, is due to a rising population from the extensive immigration to the tea-gardens, for on turning to the fever death-rates per 1000 we find that the kala-azar wave extended from 1894 to 1899 (that of 1892 having been due to influenza) during which the rate rose from 20 to 30 per 1000, falling again to an average of 23 during the last six years, a rate which is still above the average of 18 per 1000 before the invasion of kala-azar; indicating a lingering of the disease in the last affected eastern portion of the district, which still, to some

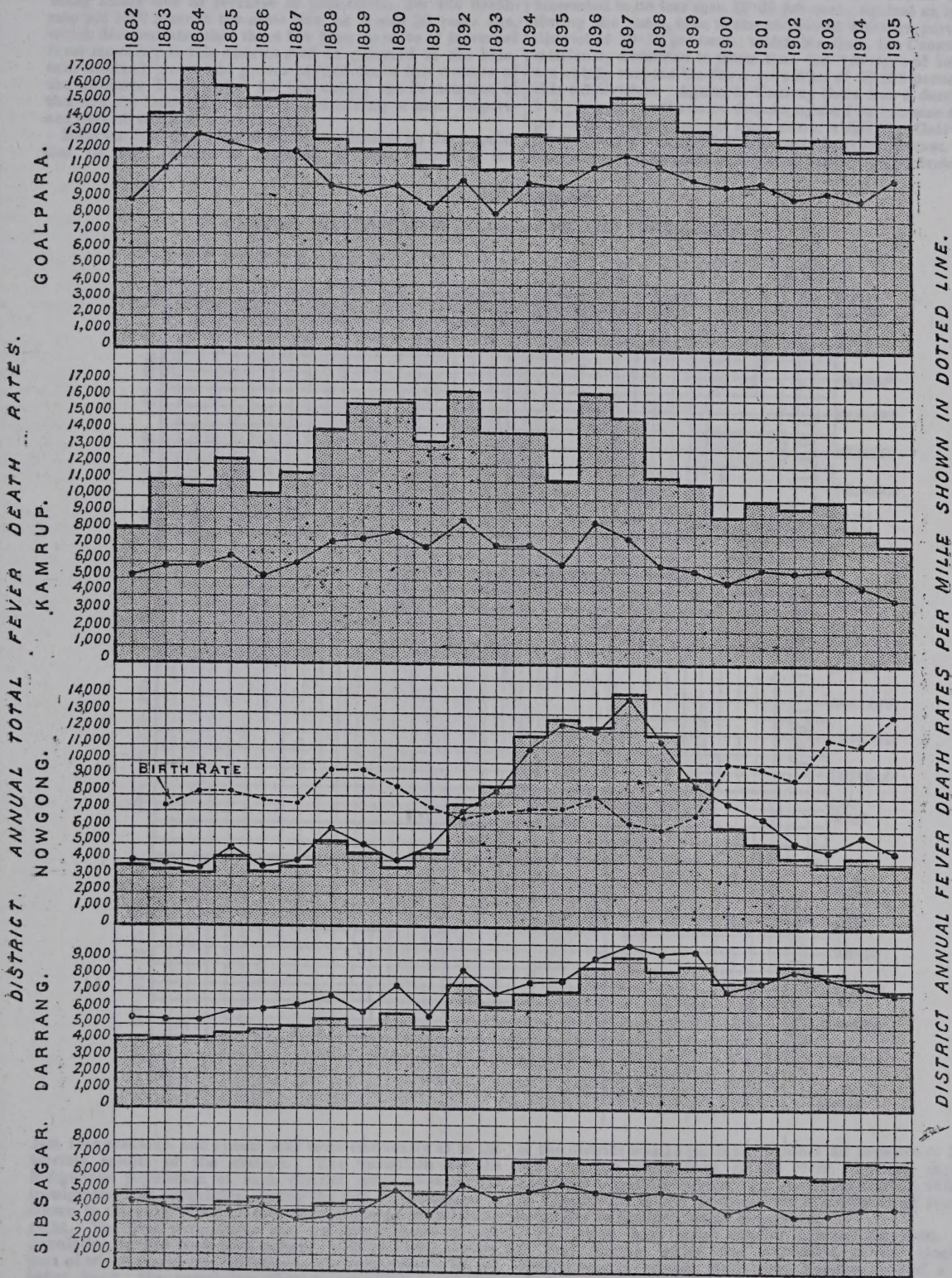


DIAGRAM II. DISTRICT FEVER DEATH RATES FROM 1882 TO 1905.

extent, threatens the more eastern Sibsagar and Lakhimpur divisions.

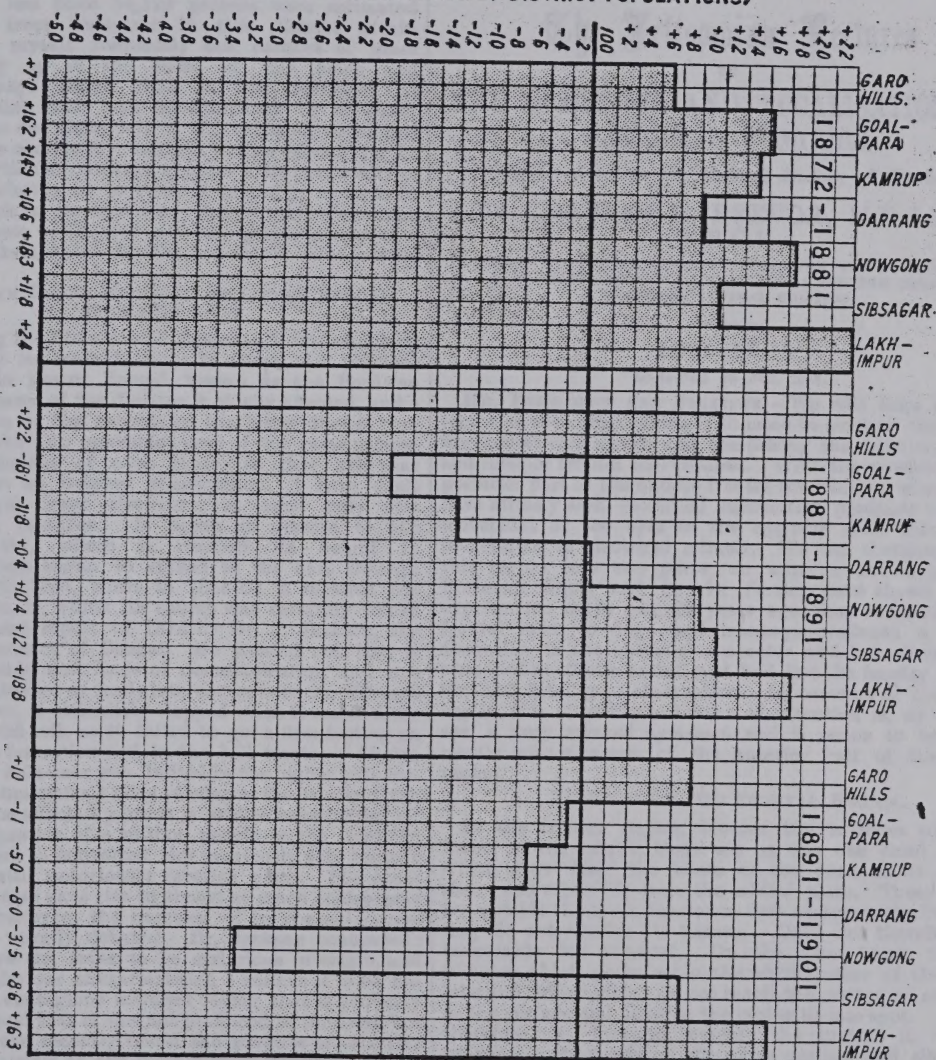
In the lowest part of the diagram the fever rates of the Sibsagar are given, the increase in the total number returned being solely due to increase of population, for the death-rate per 1000 is much the same now as it was 30 years ago, which demonstrates that there has been no wave of increased fever mortality in this district such as occurred in the kala-azar-infected tracts and proves beyond doubt the success of the measures I advocated for preventing the devastation of this and the Lakhimpur division, containing a most important part of the Assam tea industry.

Diagram III. shows the effect of the disease on the population of each district as revealed by the figures of the

and Kamrup and began to invade the western Mangaldai sub-division of Darrang. The unshaded portion below the line marked 100 shows the decrease of the population of the Goalpara sub-division in this decade to have amounted to no less than 18·08 per cent., against an increase during the same time in the unaffected northern part of the district of 19·36 per cent., which Mr. Gait, the Census Commissioner, estimated to mean that the "ravages of kala-azar are chiefly responsible for a reduction of 29,699 persons" in this subdivision. Again, in Kamrup there was a decrease of 1·6 per cent. in the same decade, against an increase of 14·9 per cent. in the previous nine years, which Mr. Gait calculated meant a loss of 75,000 persons from the disease. Here once more the decrease on the southern or badly affected part

DIAGRAM III.

CENSUS INCREASE OR DECREASE OF DISTRICT POPULATIONS.



last four censuses, and speaks still more eloquently as to the terrible results of the disease. The variations in the indigenous population of each district, after allowing for immigration and emigration, during the last three decades is shown in the order in which they were attacked from left to right. The first part shows but a slight increase of the population in the Garo hills between 1872 and 1881, during part of which period the epidemic was present there. On the other hand, the remaining districts revealed a marked increase varying from 10 to 24 per cent.

The second part illustrates the variations in the population of the same districts between 1881 and 1891, during which kala-azar overran the southern parts of Goalpara

of the district was 12 per cent., against an increase of 2 per cent. on the north bank of the river. Darrang shows a stationary population during this period, against an increase of 10 per cent. in the previous one, this absence of increase being due to the invasion of Mangaldai.

The third part shows similar figures, for from 1891 to 1901, during which the population of the Goalpara district was practically stationary, Kamrup showed a loss of 5 per cent. and Darrang 8 per cent. of its people. During this decade Nowgong felt the full force of the epidemic and its truly appalling nature is revealed by the fact that in these ten years, instead of an increase of 10 per cent. as between 1881 and 1891, there was actually

a decrease of 24 per cent. in the total population of the district, or, if the indigenous population alone be considered, the loss amounted to no less than 31.5 per cent., or almost one-third of the people, a death-rate which far exceeds that of the recent plague and to which it would be difficult to find a modern parallel, unless it be that of the closely allied sleeping sickness of Africa. On the other hand, Sibsagar and Lakhimpur again showed a substantial increase of the population, after allowing for immigration, indicating once more that this part of the valley was still unaffected by the disastrous fever. Moreover, the land has fallen out of cultivation in proportion to the loss of their inhabitants, for some figures kindly supplied me by Mr. Gait showed that one-fourth of the land in the affected parts of the Mangaldai was abandoned within five years and one-fifth of Nowgong within a similar period of time ending 1895 before the outbreak had nearly expended itself there, while no less than 54,179 persons were estimated to have died from kala-azar in this district within nine years. I myself frequently saw patches of grass jungle springing up in the midst of rice fields and on inquiry always found that it had belonged to some family which had been exterminated by kala-azar shortly before, no one being left to till the land, which had also lost its value completely, as there was no demand for it. Happily, this particular outbreak appears to be practically at an end, but it beboves us to study it carefully, so as to be prepared to check at its outset any future epidemics which may arise and also to inquire into any previous ones of a similar nature, from which further lessons of value can be learnt.

THE BURDWAN FEVER EPIDEMIC OF LOWER BENGAL, 1856-1873.

When studying the literature of kala-azar I was struck by the similarity of its main features to those of a previous fever outbreak in Lower Bengal, known as the Burdwan fever, from the name of the division it chiefly affected, and a close examination of the records of the latter disease convinced me that the two epidemics were of the same nature, although independent of each other, so that kala-azar of Assam is not an isolated phenomenon. I have dealt with this Bengal fever elsewhere, so need only now recall its main features. It began in Jessore to the east of Calcutta, where it reached its height in 1854-55, and then began to spread to the east through Nadia in 1857 to 1864, while in 1862-63 it invaded the Burdwan division, in which its course was carefully traced in a very excellent report of 1872 by Dr. J. Jackson, the sanitary commissioner of Bengal. He pointed out that it spread along roads and lines of communication and was checked by the absence of ready intercourse between different villages. Further, it ultimately stopped when it reached the edge of the alluvial soil, as it failed to get a firm footing on the drier laterite formation and in the hill tracts of Chotta Nagpur; just as kala-azar was limited by the higher hills surrounding the Brahmaputra Valley. Owing to the density of the population of the affected parts it is said to have carried off no less than a quarter of a million people in the Burdwan division alone and it converted this previously very healthy district into a still notoriously feverish place. The exact nature of the disease gave rise to almost as much controversy as its Assam prototype, the question of its contagiousness especially being warmly debated. Dr. Jackson concluded: "While I believe the fever to be malarious in origin, and to have some malarious characteristics, I believe it to be not a simple but a contagious malarial fever; that is probably typho-malarial, and that it was not produced in Burdwan but imported." I have recently found the parasite of kala-azar in some sporadic cases of the disease from Burdwan, so this outbreak seems to have permanently left behind it the endemic affection.

Kala-Dukh.—Another smaller outbreak of a similar nature, described by Major E. H. Brown, I.M.S., in 1898, occurred in the north-east of the Purneah district, immediately adjoining Dinajpur, and hence doubtless an off-shoot of the great Rungpur-Dinajpur fever outbreak, which gave rise to kala-azar in Assam. Kala-dukh depopulated a number of villages in the Nepal terai, but when I visited the place in 1904 it had nearly completely died out, only a few chronic cases remaining, while in the neighbouring part of the Dinajpur district there were fairly numerous sporadic cases of the disease, in some of which I found the parasite of kala-azar, thus establishing the identity of this small outbreak with the more extensive ones already described.

I have now completed my survey of the subject from the epidemiological point of view, having treated it in considerable detail, because I think the vast economic importance of these terrible spreading fevers is not yet fully realised out of India, and the necessity of clearly distinguishing between the epidemic and the sporadic forms of the disease cannot be too strongly insisted upon. The two disastrous outbreaks I have described both occurred within the last half century, their spread being conceivably assisted by improved communications in the affected tracts, especially in Assam, and as it is impossible to say when a fresh epidemic may be started we must be on our guard against them, for of no disease is it so true that knowledge is power, as I shall hope to show you in the course of my remaining lectures.

The Jettsonian Lectures

ON

THE DIAGNOSIS AND LOCALISATION OF CEREBRAL TUMOURS.

Delivered before the Medical Society of London,

By CHARLES E. BEEVOR, M.D. LOND.,
F.R.C.P.,

PHYSICIAN TO THE NATIONAL HOSPITAL FOR THE PARALYSED AND EPILEPTIC, QUEEN-SQUARE, LONDON; AND THE GREAT NORTHERN CENTRAL HOSPITAL.

LECTURE II.¹

Delivered on Feb. 18th.

MR. PRESIDENT AND FELLOWS,—We will take next the region of the cortex which is situated in front of the ascending frontal convolution and comprising the superior, middle, and inferior frontal convolutions. With the exception of the posterior part of the middle frontal convolution, where, as we have already seen, electrical stimulation produces conjugate movement of the eyes to the opposite side, this part is inexcitable to electrical stimuli. We can therefore divide this region into two parts, an anterior and a posterior. Professor Hitzig and Dr. D. Ferrier have shown in their experiments made over 30 years ago that removal of the frontal lobes in dogs and monkeys produced a decided alteration in the animals' character and behaviour. They remained apathetic or dull and had lost the faculty of attentive and intelligent observation. In tumours of the frontal region this stupidity and want of attention is, as we shall see, a very marked symptom and it seems to be present mostly with tumours of the anterior half of the frontal region.

TUMOURS OF THE FRONTAL REGION.

In the frontal region, besides the tumours which are found in the cortex, there are on the one hand tumours which grow from the bones or the dura mater covering them, and especially from the orbital plate. These tumours are outside the brain substance and compress the brain, but they do not involve its tissues. They are therefore most favourable for removal. On the other hand, there are tumours which grow inside the white matter of the frontal lobe and which either do not reach the cortex or only come to the surface and involve the cortex at one spot. We have therefore: 1. Tumours outside the brain. 2. Tumours growing in the cortex on the outer surface and situated in (a) the anterior half or (b) the posterior half of the three frontal convolutions. 3. Tumours growing within the white substance of the frontal lobe.

Of the first class a very typical case was the following. A woman, aged 37 years, was admitted under my care on Dec. 18th, 1903, into the National Hospital. The onset occurred seven months before admission with headache in the frontal region two or three times a week, then every day; when she had headache she was very drowsy and it was associated with vomiting lasting an hour. For two months she had had sleepy attacks in which she became drowsy; this deepened into coma so that she could not be awakened and she would sleep for days, then the sleep gradually passed off.

¹ Lecture II. was published in THE LANCET of Feb. 9th, 1907, p. 343. Lecture III. will be delivered on March 4th.

